

Putting a Price on Carbon Emissions

EES 3310/5310

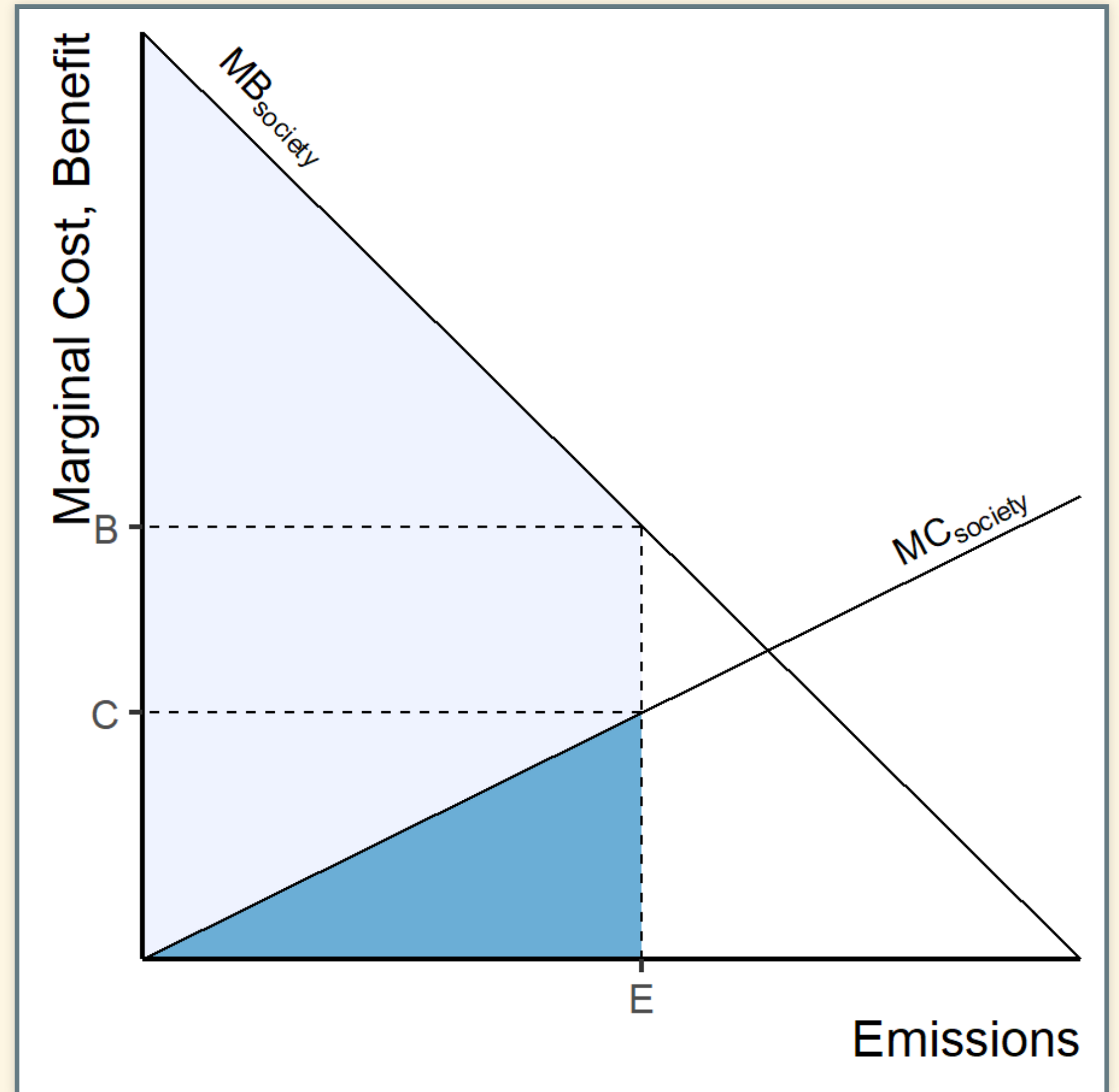
Global Climate Change

Jonathan Gilligan

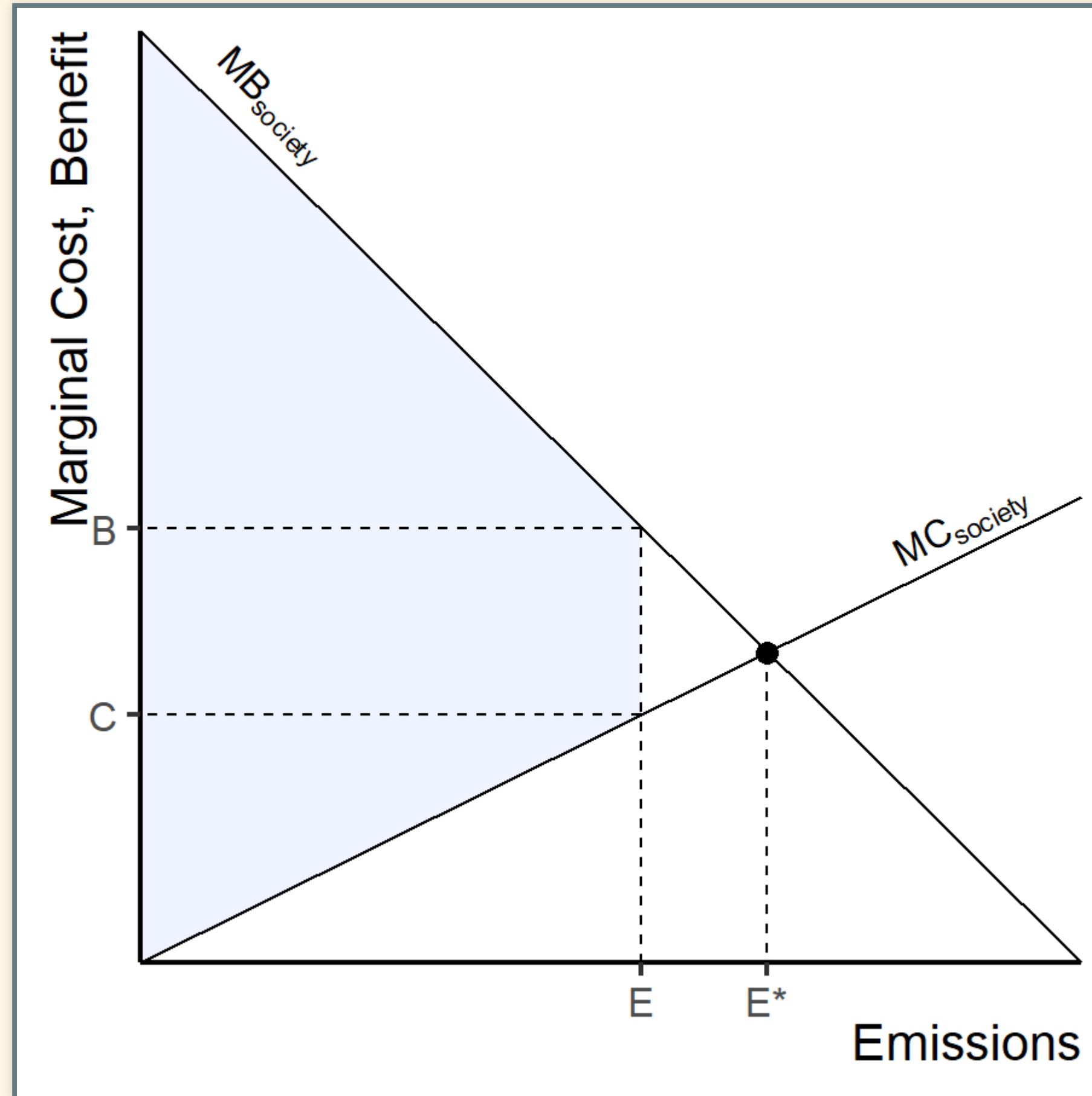
Class #31: Monday, March 30 2020

Review of Costs and Benefits

- Total gross benefit = area under MB
- Total gross cost = area under MC
- **Total net benefit** = gross benefit – gross cost
 - Light gray trapezoid

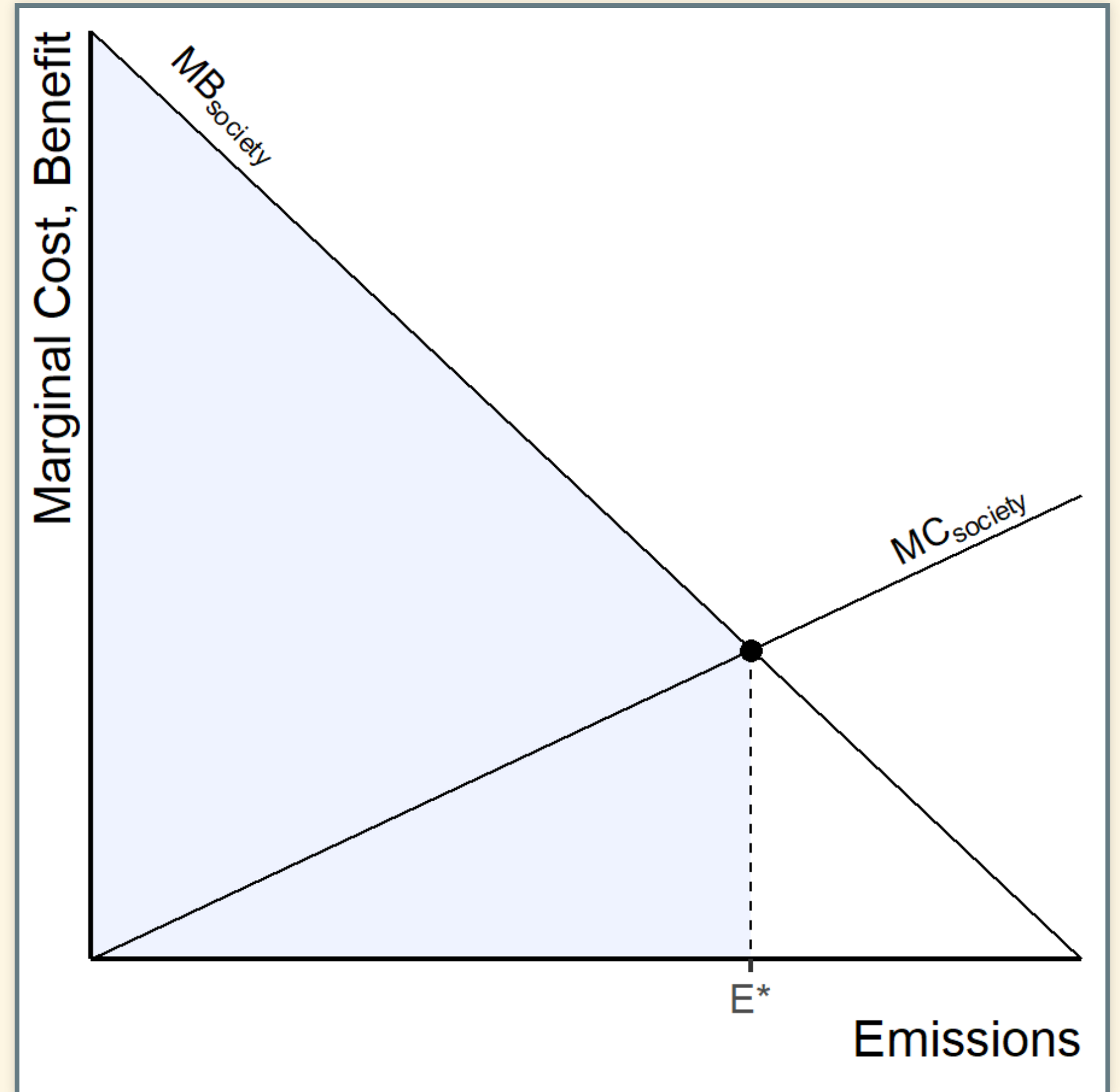


Total Net Benefit



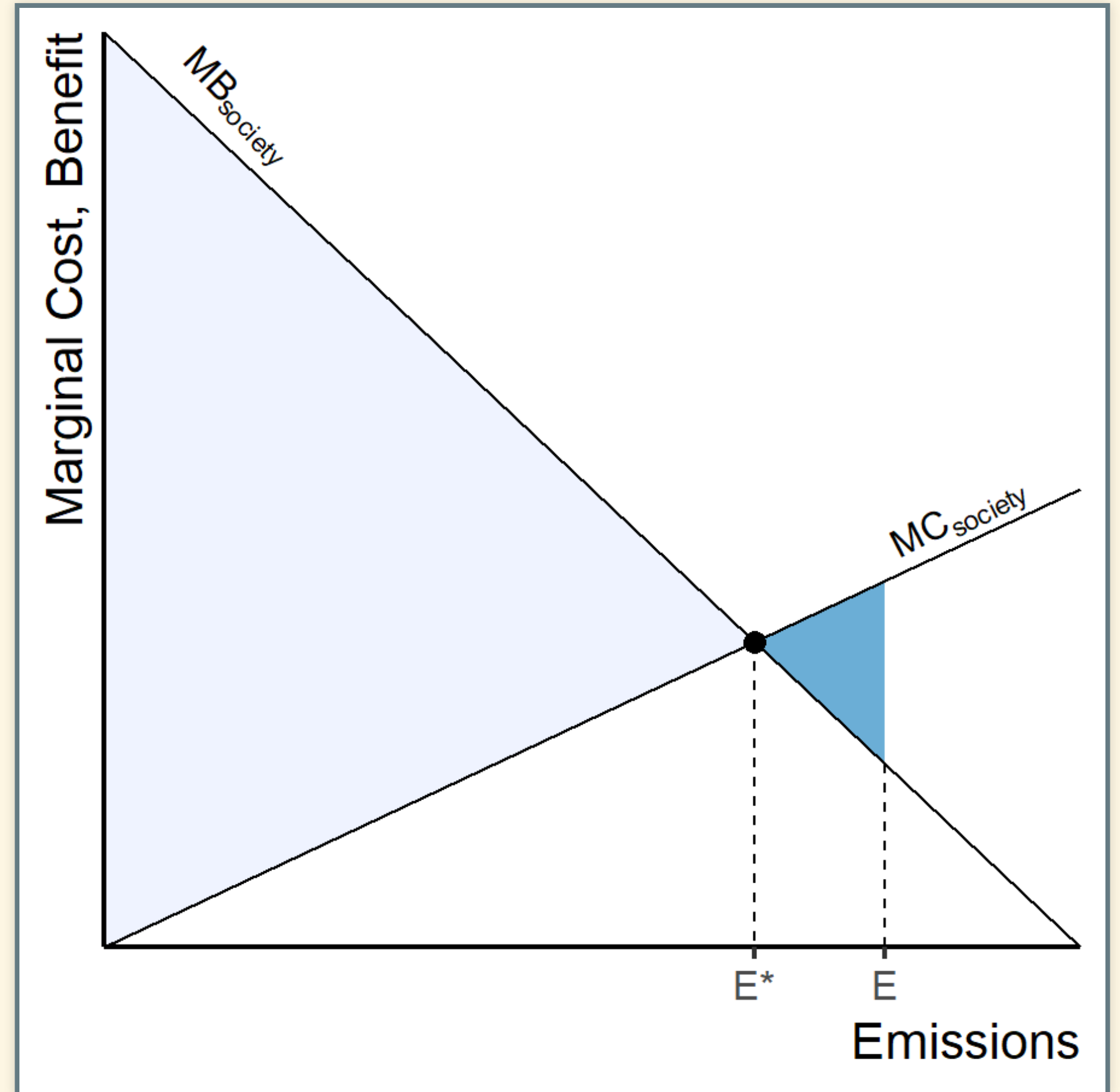
Optimum Emissions

- Optimum emissions = E^*
- EPA regulations allow E^* emissions
- Total net benefits are maximized.



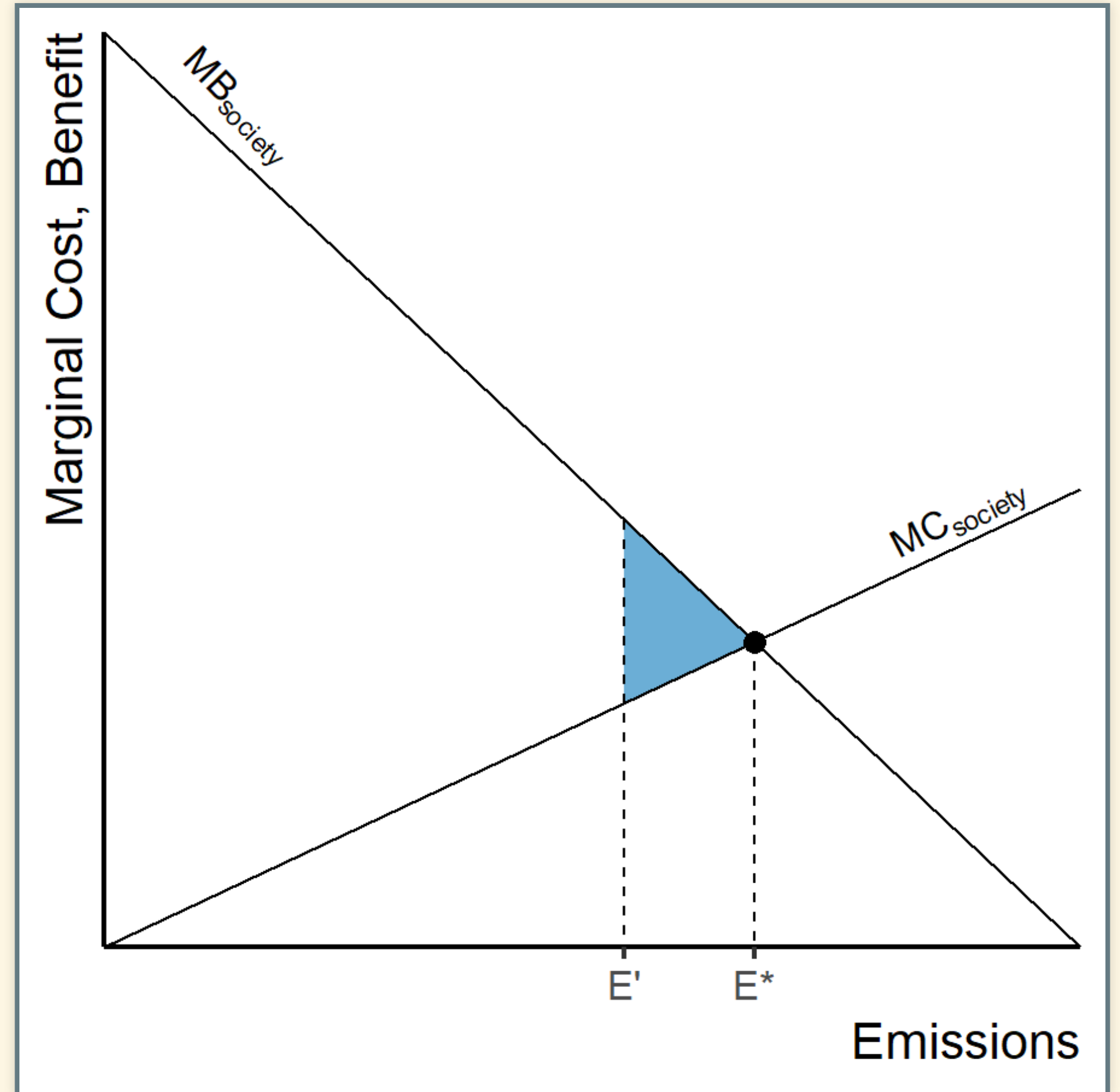
Deadweight Losses

- Optimum emissions = E^*
- EPA regulations allow E' emissions
- Deadweight Loss (dark blue triangle) = difference between **actual net benefit** and **optimum net benefit**



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Regulation

Regulation

- **Command and Control**
- **Market-Based Regulation**
 - Put a price on externalities
 - Let the market decide best balance between costs and benefits of pollution
 - *Pigovian tax*:
 - Tax equal to social cost
 - Directly compensate people hurt by pollution
 - Or rebate other taxes: indirect compensation
 - Or invest in socially beneficial projects
 - Clean energy
 - Infrastructure to adapt to climate change
 - Compensate out-of-work coal miners

Nordhaus on Pigovian Taxes

- Taxes on something makes people do less of it
- We want people to work, don't want them to pollute
- But we tax working and don't tax polluting
- Revenue-neutral carbon tax:
 - Raise tax on CO₂, cut payroll taxes

Details

- People don't like paying taxes
- *Invisible taxes*
 - Charge tax when fossil fuels are extracted from ground or imported
 - Fossil fuel producer pays tax, passes cost on to consumers
- Taxes → higher prices → less consumption
- Higher fuel prices:
 - Incentive to buy energy-efficient products
 - Incentive to invent, produce, market efficient products
 - Clean energy becomes more competitive

Simplicity of Carbon Prices

- **Command and Control:**
 - Government has to assess emissions & costs for all kinds of technology
- **Green consumers:**
 - To reduce carbon footprint, research and calculate emissions embedded in products & services
- **Pricing carbon:**
 - Simple calculation: tax carbon content of fuels
 - Consumers receive simple price signal:
 - Shop for lowest price to reduce carbon footprint

Difficulties

- Setting the correct tax rate is hard
 - Social cost of carbon is uncertain
 - Social cost depends on total emissions now & in the future
 - Set tax to marginal cost based on total emissions to date
 - Tax rises over time

Difficulties

- People are not always rational consumers
 - Both as individuals and as organizations
- Often don't notice small changes in price
- Often don't recognize opportunities to save through efficiency & conservation
- Importance of calling people's attention to places they could cut emissions and save money

Difficulties

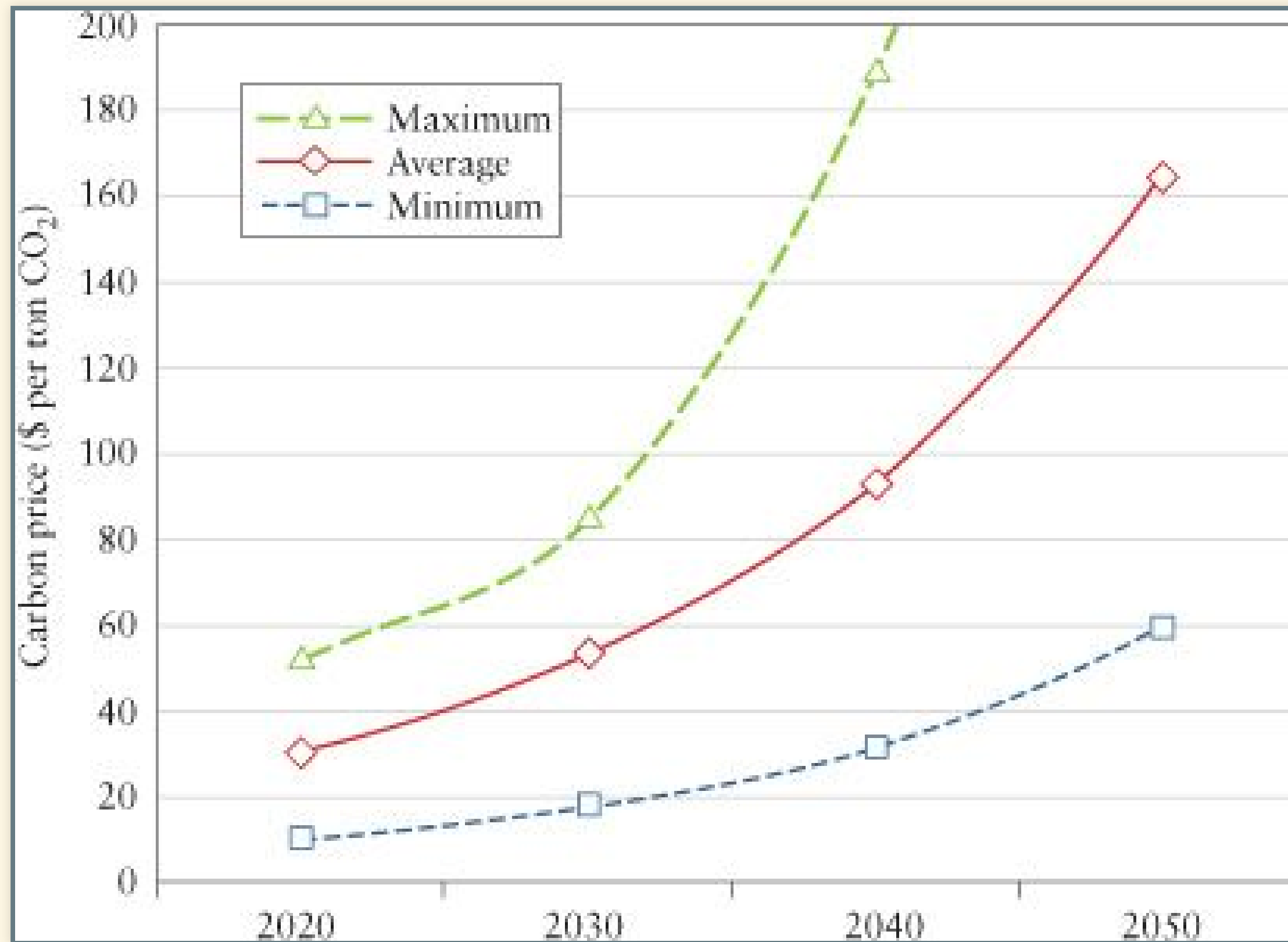
- *Offshoring*
 - If US sets carbon tax, India does not, companies will shift production from US to India
 - Big problem unless carbon tax is applied to all countries

Difficulties

- Lack of control:
 - Actual emissions depend on both *price* **and** *consumer demand*
 - If regulators underestimate demand, emissions and warming will be greater than goal
 - But if social cost is correct, this may mean benefits of energy consumption exceed damage from warming

Carbon Taxes

Example tax calculations



Tax necessary to stabilize at 2.5°C warming

Impact of \$25/ton tax

Item	Price increase
Coal	134.0%
Electricity	31.0%
Natural gas	30.0%
Gasoline & petroleum products	11.0%

Impact of \$25/ton tax on Household Spending

Item	Tons CO ₂	Cost of tax	Spending increase
Annual electricity for one home	9.34	\$230.00	19.00%
Economy-class international flight	4.68	\$120.00	8.00%
Annual phone & internet	0.01	\$0.36	0.04%
Annual total consumption for one household	30.00	\$740.00	0.90%

Impact of \$25/ton tax on National Economy

Year	Tax rate (\$/ton)	Emissions (billion ton)	Revenue (\$ billion)	Revenue (% GDP)
2010	\$0	6.30	\$0	0.000%
2015	\$25	5.90	\$147	0.960%
2020	\$30	5.50	\$168	0.970%
2025	\$42	5.40	\$225	1.140%
2030	\$53	5.20	\$277	1.250%

- Tax starts in 2015 at \$25 per ton
 - Rise steadily so emissions stabilize at 2000 levels by 2030
 - Carbon tax can be used to reduce deficit or cut other taxes
- However, this tax seems very inadequate to limit warming to 2°C.
 - The longer we wait, the higher the tax must be to achieve a policy goal.

Discuss